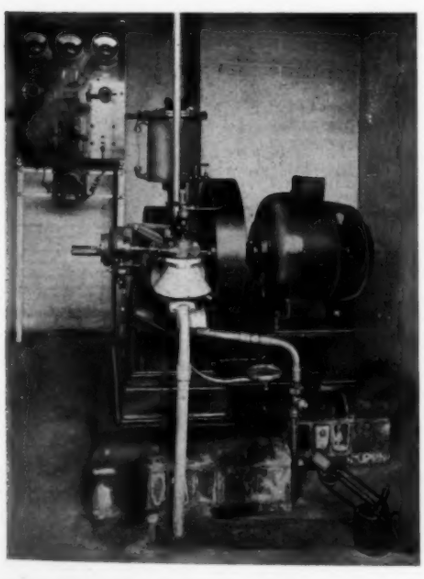
ENGINES FOR ELECTRIC PLANTS.

IT is not so many years since the country resident who desired to introduce motive power on his estate or into his house was practically compelled to adopt the steam engine. The coming of the motor-car, however, brought into the field a new prime mover—the petrol engine—which has deservedly become the most popular type of engine for small powers at the present day. On account of its almost universal use on the motor-car, it has one outstanding advantage—its idiosyncrasies are well understood. It has, willy nilly, been made to go on the road, under much severer conditions than ever exist when it is used, say, for driving a dynamo, and this, coupled with the fact that it is extremely compact and self-contained, requires little space and inexpensive foundations, and can be started up by the turn of a handle, generally makes it the most suitable engine for driving a small dynamo.

A BATTERY ROOM.

The majority of people, especially those who use a car, will probably favour the petrol engine, although it should be remembered that it is only the junior member of the "liquid fuel" engine family, and conditions may arise where paraffin or crude-oil engines are preferable; they are certainly cheaper to use, paraffin being cheaper than petrol, and crude oil much less expensive than either. Then, again, the claims of the suction-gas engine must be considered when any considerable amount of power is required, and this applies also to the crude-oil engines operating on the Diesel principle, the admittedly lower fuel costs of both these engines being sufficient to compensate for certain disadvantages as compared with the simple petrol engine.

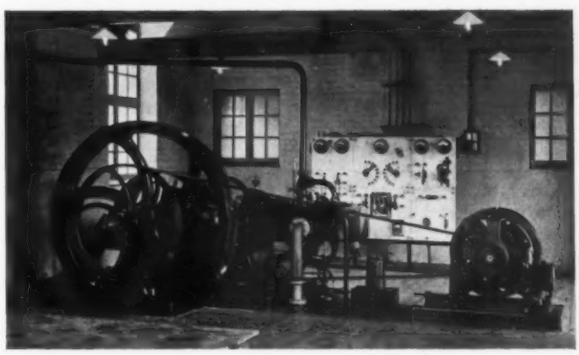
Constructively, the petrol, paraffin and ordinary crude-oil engines differ very little, and, in fact, are often adaptable with but slight alterations for either fuel; the power which the engine develops, however, decreases more and more as the class of fuel becomes cheaper. This, of course, means, in other words, that a larger engine is required with cheap oil fuel than with petrol to give the same power. This, however, does not necessarily mean increased first cost, as the following figures for combined engines and dynamos will show: The cost of an ordinary 3-kilowatt petrol set running at 700 revolutions per minute would be £99; that of a high-grade 2½-kilowatt petrol set running at double the speed, £115; of a 3-kilowatt paraffin set running at 900 revolutions, £105; a similar high-grade set of 2¾ kilowatts and 800 revolutions costs £128; and for a 2¾-kilowatt 800-revolution crude-oil set the price would be, say, £97, from which it may be inferred that the maker's name has a considerable influence on the first cost.



TYPICAL SMALL OIL ENGINE PLANT.

The engine and dynamo are usually sold complete, the former with its fuel tank and piping, magneto ignition, silencer, etc., and the latter with a shunt regulator; an extra £5 or so may be allowed for the cooling-water tank and piping for connecting to the cylinder jacket. The paraffin engine is usually started by running it on petrol for a minute or two, and this involves the complication of a double fuel tank and extra piping; an alternative method is to warm the vaporiser before starting by means of a blow-lamp. Whether petrol or paraffin be used, about three-quarters of a pint per brake-horse-power-hour will be required, the cost, however, being 1s. 3d. per gallon (less tax) in the first case, as against 5d. to 6d. per gallon in the second, while crude-oil engines burn a still cheaper unrefined oil costing from 2d. to 3d. per gallon. Whatever the engine adopted, it should be amply large enough for its work; the valves should be readily accessible, the lubrication to all parts automatic, and the flywheel fairly heavy in order to ensure steady running.

We may complete our reference to this class of engine by a few remarks on the so-called Diesel type engine (made by several firms), which during the last few years has obtained deserved popularity for electric-lighting purposes, on account of its uniformly low fuel consumption of about half a pint of oil per brake-horse-power-hour, for both small and large powers. Small single-cylinder engines of 5 h.p., running at a speed of 600 revolutions per minute, for driving dynamos have only recently been produced abroad; and as these require no more than half a pint of crude oil per horse-power-hour, which at 2½d. per gallon works out at three farthings an hour for the above engine fully loaded, they effect a great saving as compared with the 2½d. an hour for a paraffin engine of similar size. The Diesel type engine is always ready to start instantly. Unfortunately, it is costly in the first instance, and, moreover, it requires skilled supervision, which, however, would almost be a necessity in the case of a fairly large plant, for which it is more particularly suited at the prseent time.

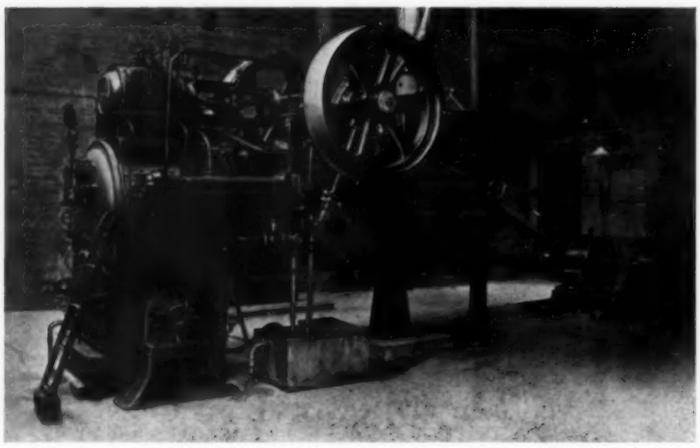


TYPICAL LARGE OIL ENGINE PLANT.

When we come to consider the comparatively large electrical installation, the claims of the suction-gas engine must be considered if a suitable fuel, such as coke or anthracite coal, is readily obtainable. The space taken up is considerably greater than in the case of a liquid-fuel engine, as, in addition to the gas engine, a gas producer and gas-filtering apparatus have to be installed. The plant requires some ten to fifteen minutes to start up after standing; but given intelligent supervision of the producer, it will run for some hours with practically no attention when once this has been charged, the gas production being automatically controlled by the running of the gas engine. A plant of this kind requires from 1lb. to 1½lb. of fuel per effective horse-power per hour, and the fuel may cost anything from 10s. 6d. to 30s. per ton, according to locality; a fuel cost of one-eighth of a penny per horse-power-hour is frequently claimed for this class of plant. The first cost of an engine, producer and cleaning plant varies from £190 for a 10 h.p. plant to £330 for a 25 h.p. plant. It should be noted that whereas an oil engine consumes no fuel when once stopped, a suction-gas plant (in common with a steam boiler) slowly consumes fuel, even when doing no work, amounting to 2lb. or 3lb. per hour for a plant of 50 h.p. to 100 h.p. This however is an almost negligible factor, and hardly needs to be taken into account in considering the merits of suction-gas as

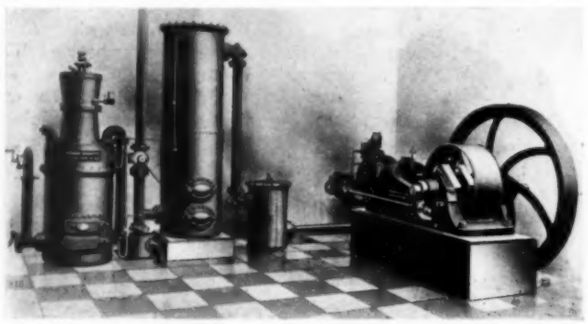
compared with other systems. Owing to the slightly corrosive effect of the gas on copper, care should be taken to separate the electrical apparatus from the gas producer. Many highly successful suction-gas plants are in use for country-house lighting.

While on the subject of gas plant, it may be worth noting that the ordinary gas engine, constructed for use with illuminating gas, is often worth considering in view of the extended distribution of the latter even in country districts. An engine of this type is smaller for its output than a suction-gas engine, and as it draws gas practically direct from the public supply, it is obviously more convenient, more easily started and less complicated. In fact, it is comparable with the liquid-fuel engine, being less costly than the latter, in the first instance, but more expensive to run unless the gas is obtainable at an exceptionally cheap rate.



25 H.P. HIGHLY SUPER-HEATED STEAM ENGINE WITH DYNAMO.

An article of this kind cannot be concluded without some mention of the steam engine, although, as usually made in small sizes, this has little to recommend it unless exhaust or reduced pressure steam is required for other purposes, such as for heating, cooking or the laundry. When this is so, however, a good case can be made out for the more recent type of highly super-heated steam engine combined with the boiler. Such a plant, consisting of a locomotive type boiler with an engine mounted over it, can, in the small sizes, be run with a coal consumption of from 1¼lb. to 2¼lb. per horse-power-hour, depending on whether the engine is a compound or simple one. The exhaust steam would be passed through a feed-water heater, from which hot water for boiler-feeding and other purposes could be drawn. A 25 h.p. engine and boiler of this type would cost about £300, but a less efficient plant can be obtained for less. Here, again, it must be remembered that during the time when the engine is not running, a small boiler will consume from 10lb. to 20lb. of coal an hour. One point in which the steam engine outdistances all its rivals is that it will take a very much heavier load than it was intended for if necessary, and such as would pull up a gas or oil engine; for this reason it is more reliable, where motor-driven machinery is employed and the demand for electricity rather uncertain, than the other types of engine.

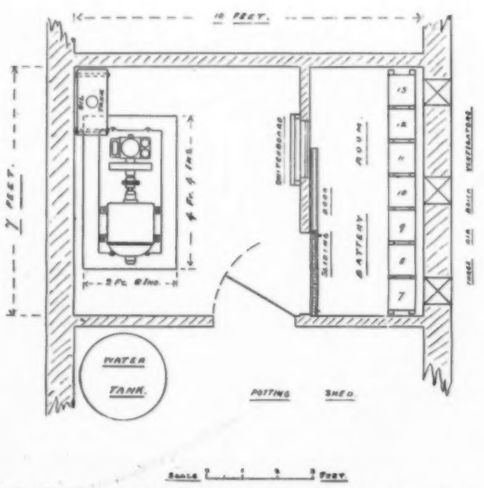


SUCTION GAS ENGINE AND PLANT.

A steam plant situated in the country should, in any case, be insured with one of the insurance companies, as the regular inspection of a steam boiler, in addition to being necessary, is a safeguard to the owner which is well worth the fee charged. The accompanying illustrations will give some idea of typical engines of the classes referred to in this article. B. A. T.

ELECTRIC GENERATING & STORAGE PLANTS.

WHILE electric lighting has been for many years without a rival in respect of its cleanliness, convenience and safety from fire risk, it has suffered from one important drawback which has limited its adoption in country houses—the necessity of providing a supply of electricity on the premises. In addition to the high capital cost of the generating plant and the large storage battery, the difficulty of ensuring adequate supervision of the apparatus had to be faced, and these considerations greatly retarded the growth in popularity of the electric system. Fortunately, during the last few years developments have taken place which have completely changed the situation. On the one hand, the general adoption of the petrol engine for driving motor-cars has led to the evolution of small engines actuated by paraffin or petrol, which can be trusted to run for hours without attention, and require the minimum of attendance; and, on the other, the invention of the metallic-filament lamp, which consumes less than one-third of the electricity demanded by the lamps in use five years ago, has reduced the dimensions of the storage battery, as well as of the engine and dynamo, in a corresponding ratio. Thus the cost of an electric-lighting installation is now certainly less than half what it used to be, and the attendance problem has been divested of its difficulties—especially where a chauffeur is employed. The space required to accommodate the whole of the plant has also been brought down to a trifling amount. The accompanying figure shows how an engine, dynamo, switchboard and storage battery for an installation of 150 lamps were housed in a room measuring only 7ft. by 10ft. It is not advisable to cut things so fine if it can be avoided; but it will be seen that it can be done in case of need, and even this achievement has been improved upon.



PLAN OF COMPLETE INSTALLATION FOR 150 LAMPS.

Another important advantage derived from the economy of the new type of lamp is the fact that a much lower electric pressure can be employed. Hitherto it has been customary to use a pressure of at least 60 volts, and often 100 volts (in the case of the larger installations); but with tungsten lamps a pressure of 25 volts is sufficient even for an installation of 150 lamps, and the plant figured provides this pressure. As the number of cells in the storage battery depends directly upon the pressure adopted, a very great gain is here effected—13 cells sufficing, as compared with 33 cells or 55 cells under the old conditions. Moreover, at so low

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a pressure as 25 volts the slight risk of fire incidental even to the use of electric light is totally eliminated, and the fittings can be handled without the least possibility of receiving an electric "shock." It should, however, be mentioned that if electric heating or cooking is contemplated, in addition to the lighting, it is inadvisable to use a pressure lower than 50 volts, as the flexible conductors used for the connections of such apparatus would have to be of clumsy dimensions at 25 volts; but, seeing that the vast majority of town houses are supplied at a pressure of 200 volts to 250 volts, it will be obvious that 50 volts is a remarkably low pressure.

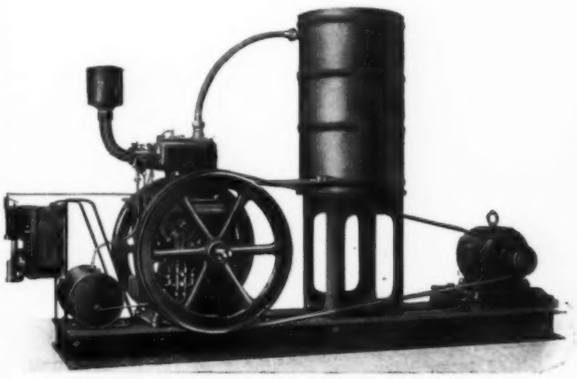
Where there is ample space available, one of the cheapest types of generating plant to instal is a high-speed dynamo driven by a leather belt from a paraffin engine, and this well-tried combination can be relied upon to give thorough satisfaction. Where the space is limited, it is better to use a dynamo directly coupled to the engine on a cast-iron bed-plate; and, indeed, there is much to be said in favour of this system in point of convenience and simplicity, though it is more costly. The remaining apparatus in connection with the generating plant comprises a tank to contain the oil or petrol which constitutes the fuel for the engine, and a water tank—which may be fixed outside the engine-room—for cooling the engine cylinder.

The storage battery usually consists of a set of glass boxes containing the accumulators, in which the electrical energy is stored up during the daytime, in order to avoid the necessity of keeping the engine running continually. As already mentioned, for a 25-volt installation only 13 cells are required (for 50 volts, 27 cells), and, if possible, these should all be mounted at the same level for convenience of access; where the space available does not allow of this, they may be arranged on a wooden stand in two tiers. The cells are all permanently connected together and to the switchboard, which also controls the dynamo and the lighting circuits to the house. Three cells at one end of the battery are used as regulating cells, and are cut off the lighting circuits when the dynamo is being employed in charging the battery. They are switched on one by one as required when the battery is feeding the lamps, to make up for the falling pressure, but this operation is only occasionally necessary. It is effected by means of a special switch on the switchboard. The working of the plant is quite simple. When the engine has been started and run up to full speed—a process easily learnt by a gardener, and, of course, child's play to a chauffeur—the dynamo is connected to the battery by means of a switch, and the charging current is regulated to the proper value. The plant can then be left to itself for some hours, the only attention required being to regulate the charging current. When the battery is fully charged, as shown by the instruments provided, the engine is stopped. As a matter of fact, the procedure is so simple that it can actually be entrusted to the care of a machine, and generating sets are on the market which carry out the whole process entirely automatically. Where one of these is installed, all that the attendant has to do is to see that the lubricating devices are kept supplied with oil, and that there is sufficient petrol in the tank. When the battery is discharged to a certain point, the engine automatically starts up, and the dynamo charges the battery until the latter is full again, when the engine automatically stops!

We must not give the impression that attendance can be wholly dispensed with, for it is necessary, in order to ensure the satisfactory working and long life of the storage battery, to examine this from time to time—once a week or fortnight—and to add a little distilled water to the cells when required. But batteries are so well made nowadays that there is little likelihood of their giving trouble, though they must be regarded as the weakest link in the chain between the fuel oil and the electric lamps.

The cost of such an installation as that described above depends, of course, upon the number of lamps and other apparatus to be supplied with electricity. Including the engine, dynamo, switchboard and accumulators only, with the necessary accessories, the cost of the plant for an installation of 50 lamps of 20 candle-power each would be about £100; for 150 lamps, £180; and for 250 lamps, £280. These figures relate to a 25-volt or 50-volt installation, with a direct-coupled engine and dynamo. The majority of country-house installations fall within the range of the sizes given.

ARTHUR H. ALLEN.



AN AUTOMATIC SELF-CONTAINED LIGHTING PLANT.
Showing engine and dynamo, with accumulator cabinet and switch gear.

ELECTRIC LAMPS.

"IF we interpolate two carbon rods in an electric circuit, we produce what is called a voltaic arc." These words have an old-fashioned air about them which bring a smile. Should we wish, however, to trace the idea of electric lighting to its origin, we find ourselves contemplating this laboratory experiment of Volta as the seemingly insignificant source from which the most modern system of lighting has sprung.

It was, perhaps, the intense brilliancy of the light produced by an electric arc between two carbon rods which aroused the interest of inventors, and the number of arc lamps patented during the succeeding years are evidence enough of this widespread interest.

It was not long, however, before a demand made itself felt for a lamp that required no mechanism to feed the carbons forward as they burnt away, and as a result of this demand the electric candle was invented. A Russian officer, Jablochkoff by name, was the first to patent this apparatus as early as 1872. It consisted of two carbon rods fixed side by side and insulated from each other with kaolin. There were many difficulties, however, and after being extensively tried for public lighting, both in London and Paris, the Jablochkoff candle was given up.

The demand for an electric lamp without mechanism still existed, however, and, coupled with it, there was also a demand for a smaller unit, as the quantity of light emanating from one point rendered the arc unsuitable for private lighting. Many efforts were made to obtain a lamp of smaller candle-power, using correspondingly less current; and we find the demand met at last by the incandescent electric light which was brought out first in 1842 by Frederick Moleyns of Cheltenham. The filament of this lamp was made of platinum; but in 1848 the first patent for a carbon filament was taken out. It was many years, however, before this latter was brought to perfection, and the Edison lamp with a platinum filament held such field as there was at that time. The later carbon-filament lamp was brought out by Edison in 1879, and the commercial application of the electric incandescent lamp may be said to date from this time. There have been modifications and improvements in the manufacture since, but the carbon-filament lamp has remained practically unaltered, and held the monopoly for indoor electric lighting till the invention of the metallic-filament lamp a few years ago. It is true that at one time this virtual monopoly was threatened by the advent of the Nernst lamp; but the invention of the metallic filament followed so soon after the Nernst that the latter never had a chance to become widely popular, though the brilliancy and whiteness of the light it gave were generally recognised.

The coming of the metallic-filament lamp was of overwhelming importance to the electrical industry. The saving of current effected is such that the same amount of light can now be obtained by the expenditure of one-fourth the amount of power formerly necessary.

Only two metals have been found suitable for the manufacture of metallic filaments—tantalum and tungsten. The former uses slightly more current for a given amount of light than the latter; but until recently it had this compensating advantage—that it could be drawn into a wire in spite of its refractory nature. Until quite lately, however, this was found to be impossible with tungsten; but means have at last been discovered for doing this, so the tantalum wire filament loses much of its comparative advantage. Practical experience has shown that, in such places as rifle ranges or where vibration is excessive, a tantalum lamp may still prove cheaper in the long run, though it consumes more current. In the early days of the tungsten lamp the fragility of the filaments was a great drawback; but improved methods have followed each other in rapid succession and filaments are now quite strong enough to stand ordinary handling both in transport and installation.

The economy effected by the metallic filament has been so far-reaching that the supply companies have hardly yet adjusted themselves to the new conditions. Country householders who have private installations erected in the days of the carbon filament find themselves with a reserve of generator and battery capacity, which enables them to run electrically-driven, labour-saving devices about the house and on the estate to an extent impossible in the days before the change.

The carbon-filament lamp is still useful in cases where economy is not the sole consideration, and where decorative effect is also an aim. In the first place, the metallic-filament lamp is rarely made smaller than sixteen candle-power for ordinary lighting voltages. Secondly, it is only recently that metallic-filament lamps can be obtained to run in any position but the vertical. These are important limitations where decorative lighting is under consideration. The candle lamp, which has saved to our use and enjoyment so many of the antique candelabra and chandeliers which were in danger of being turned out as obsolete, is still made with a carbon filament of fairly low candle-power, and gives a light which approximates in colour to the natural candle flame, in contrast to the brilliant white glare of the metallic-filament lamp. In the case of small coloured lights for table decorations, where low candle-powers and capacity for burning in any position are necessary, the carbon filament again carries the day.

Some of us who are, perhaps, beginning to feel the passage of time may sometimes have wondered if Goethe's dead-cry for more light has not been interpreted too literally by a materialistic generation. The light of sunset is red, golden and subdued; it brings peace with it. If our rooms are always to be kept at noonday brilliancy, is there not some danger of our losing this peace altogether? At any rate old-fashioned lights, even the *old-fashioned electric lights*, had more of the colour of the sunset in them; but, like all old-fashioned and pleasant things, they are an expensive luxury in these days.

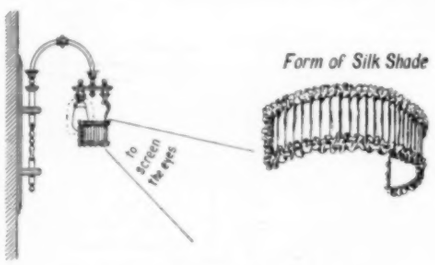
MAURICE HIRD.

DOMESTIC ILLUMINATION.

THE lighting of the home is still one of the most neglected branches of illumination. We have an abundance of pretty shades, sparkling glassware, Oriental lanterns and other "artistic" accessories; but these are of small comfort if they fail to achieve the main purpose of the art of illumination, viz., to make readily and properly visible the things required to be seen. As far as the production of light is concerned, there is every reason to be satisfied with the marvellous progress that has been recently made, whether in quality, colour or cost. But it is one thing to have a good article; it is quite another to know how to use it, and in this field there is much to be learnt.

GOOD AND BAD LIGHTING.

"There is no form of functional nervous disorder," says a medical authority, "that may not be caused or aggravated by eye strain," and in domestic lighting this trouble is commonly the result of inadequate light and misplaced lamps. The other extreme—excess of light—is productive of direct injury; but this is due not so much to quantity as intensity, violent contrasts and glare, for broad daylight is a thousand times brighter than any interior lighting, and we thrive under it. Contrast in lighting is a matter of surroundings. The brightest lamp is almost invisible in open daylight; but that same lamp placed in a room against, say, dark oak panelling, may be intolerably brilliant. In such a room the eye is alternately striving to protect itself against the intensity of the light and labouring to perceive the details of the darker areas, which causes a succession of pupillary and retinal adaptations that can but result in fatigue and injury. Another distinction between good and bad lighting may be found in its degree of fitness for the service of art and for the practical purposes of life. The simple-minded man would imagine that a lighting installation is put in to enable people to see things; but in nine houses out of ten it serves but to defeat its own ends and to impair visual acuteness. Thus a spreading chandelier with flower-shaped shades, that shade nothing, will dominate a room, while one has to peer painfully around and under it in order to discern anything. Pictures are but patches of glare, writing and needle-work are often impracticable, and gleaming points in vestibule and staircase lead us to stumble over mats and steps. Then as to its service in matters of art. The beautiful old houses of England were obviously designed for daylight, since our ancestors—if report be true—retired at sundown. Even if they did not, pine log and candle were a poor substitute for sunshine. In these days society, like the *Nicotiana affinis*, blooms at night, and, in doing so, claims the benefits of modern engineering. A hall or a dining room with any architectural pretensions should be so illuminated as to produce the effect intended by the designer. Illumination should, indeed, go further, for tapestries, carvings and other works of art are often, by force of circumstances, so placed that they cannot be seen properly by daylight.



AN EFFECTIVE SHADE.

DECORATION AND REFLECTION.

The great influence of ceilings, walls and other reflecting surfaces upon the economy of illumination is not always appreciated; a deep crimson or ultramarine wall-paper, for example, eats up 85 to 95 per cent. of the light it receives, and to make it reasonably visible the lighting power would have to be enormously increased, whereas a white surface absorbs but 15 per cent. and reflects the remainder. An enclosed room enjoys the advantages of reiterated reflection, in which case the total illumination in a white room may amount to as much as three times that from the lamps alone. In practice, however, the effect of reflection is to add 10 to 100 per cent. to the initial light of the lamps, according to the colour of the walls, etc. I am by no means advocating uniformly white rooms—they are apt to be monotonous and fatiguing both to eye and mind; but, provided that the white be varied in tone, there is much to be said in their favour. Certainly, rooms darkly decorated might be much lighter without trespassing on artistic sensibility, and with considerable advantage to illuminating value.

SUCCESSFUL ILLUMINATION.

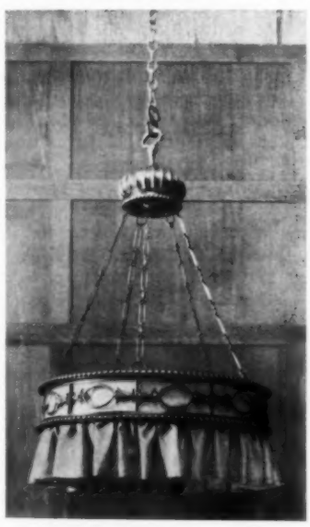
The elements of successful illumination lie in a removal of all bare and inadequately-shaded lights from the field of vision, and in the provision of ampler means of diffusion. To this end, the lights, under some circumstances, may be kept close to the ceiling and be thus covered by the eyebrows. The ceiling bowl illustrated is one among many serviceable forms of fittings, but in domestic illumination the most convenient means is the use of well-devised shades. The glass transparencies which are seen everywhere serve little or no purpose; the lights they enclose are perpetually in conflict with the eye, and they give a cheerless and uncomfortable effect. Shading should be real and effectual, but there is no reason why it should darken the rooms or do any more than protect the eyes. An economy shade of this description is here sketched; it is not more than 3in. wide, and is perfectly efficient. For the dining-table nothing is more efficient than a hanging lamp with silk flounce, which must be deep enough to screen the eyes in sitting and standing. The top should be flat and filled with an opal glass plate, both for cleanliness and for lighting the ceiling. The ends of a long dining-table are well served

by standard lamps or by candlesticks, but either must be adequately shaded.

INDIRECT LIGHTING.

The entire concealment of lights is another and charming means to the same end. In view of the large proportion of light which may be obtained from an illuminated ceiling and other surfaces, it is surprising that the advantages of indirect lighting have been so long overlooked. When properly devised, there is no form of lighting that gives greater eye comfort or so pleasantly approaches daylight in effect. Any source of light may be employed, but tungsten-filament glow lamps are, perhaps, the most suitable. One of the simplest methods is to place the lamps in a bowl pendant. Fascinating results may be obtained by concealing the lights behind screens or above cornices. A diagram shows the latter arrangement, which, in large rooms, may be supplemented by pendants.

BOWL PENDANT.



CORONA PENDANT.

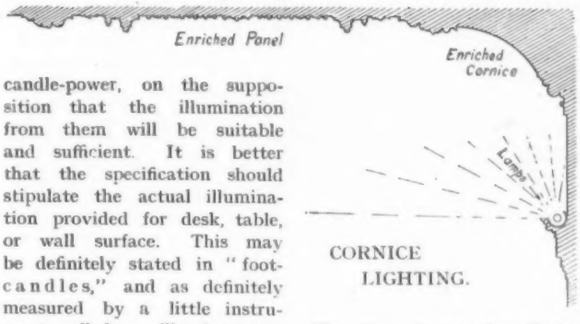
CEILING BOWL.

PICTURE LIGHTING.

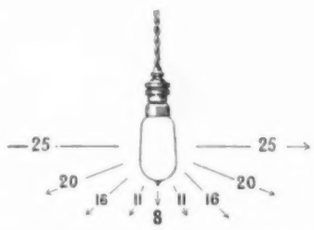
Many lovers of pictures have gone to considerable expense in illuminating them for evening inspection. Pictures in a special gallery are best illuminated from a distance, but isolated pictures can often be satisfactorily illuminated by special picture-lighters. Such a lighter or reflector, if it fails to spread the light evenly, or if it causes a reflection of itself in any part of the picture, is worse than useless. I have in mind a picture gallery in a town house containing scores of pictures, each separately lit by silvered reflectors, so ill-devised that two or more patches of glare appear on each, whatever the point of view. Another important question is that of colour. The yellow light of the carbon electric filament or of the gas flame fails to exhibit a picture in its true colours. Yellows are dulled, blues and greens are darkened or made greyer, with other variations intolerable to the artist's eye. A pure carbon arc lamp—preferably in its inverted form—will give the purest colour to the pigments; and it may be added that it is possible to get an arc lamp that will burn steadily both as to intensity and colour. The tungsten-filament lamp, however, gives excellent effects in colour.

LIGHT *v.* LAMPS.

When an electrician enters into a contract with his customer, it is usual for him to submit a schedule of lamps, each of a given candle-power, on the supposition that the illumination from them will be suitable and sufficient. It is better that the specification should stipulate the actual illumination provided for desk, table, or wall surface. This may be definitely stated in "foot-candles," and as definitely measured by a little instrument called an illuminometer. The time is not far distant when the average man will know, and ask for, the light suited to his needs in terms of foot-candles, just as he knows the right temperature for his bath or the size of his gloves. The foot-candle is a measure of intensity of light falling on a surface, one foot-candle being the light of one standard candle at a distance of 1ft.; but as a 25 candle-power lamp at a distance of 5ft., or a 100 candle-power at 10ft., give no more than one foot-candle, the importance of stipulating light rather than lamps becomes obvious. There is another reason why light should be specified. A modern glow lamp may be rated at 25 candle-power, but it by no means follows that it will throw that amount of light in the direction needed. The accompanying diagram shows the distribution from a metallic-filament lamp. This can be modified by shades and reflectors. It would be impossible, in a short article, to advise the amount of light proper to the various rooms of a house, as the question is complicated by that of decoration and of general, as compared with local, lighting; but it may be said that at least three foot-candles are needed for reading and white needlework, and ten foot-candles for what a needlewoman calls "black work."



CORNICE LIGHTING.



DISTRIBUTION FROM 25 C.P. METALLIC-FILAMENT LAMP.

WELL-SHADED STANDARD

ECONOMY.

Economy is generally the keynote of every installation, but that much-abused word is too often employed in tightening the purse-strings, when it would have better expression in a more liberal treatment of necessities. The commercial world has begun to find out that the extra cost of better illumination is repaid a hundred-fold by time saved and better results. Likewise in the service of the house, no less than in the family rooms, stinted light brings no economy when it results in inefficient work, dirt, damage to property,

DOUBLE SCONCE.

BOWL AND CANDLES.

aching eyes and swollen doctor's bills. On the other hand, it is not necessary to expend large sums either in installation or maintenance, and good and sufficient illumination may be obtained with no more than an average expenditure, while a considerable saving may often be effected by a well-informed and rational handling of the light.

DECORATIVE LIGHTING.

So far, domestic lighting has been considered from the point of view of efficiency and the avoidance of eye trouble; but it must be recognised that there is another aspect of the problem, viz., that in which the lighting itself forms a decorative feature. There is an undeniable attraction in the sparkle and glitter of many points of light that adds largely to the brilliance and gaiety of the ball and reception room. It is the naked lamp alone that is able to impart such a chromatic splendour to the great chandelier of cut glass, and, grouped in brilliant constellations on candelabra and wall sconce, it draws a vivid flash from every jewel. The great, many-branched chandeliers may be expected, therefore, to retain their popularity—at least for the present. It is possible to aim at getting the best of both worlds, as in the case of the pendant illustrated, the bottom of which is a glass dish giving screened and reflected light, while there are candle branches above.

Art delights in the enlistment of its treasures in the service of the home. Thus we often find old Pompeian lamps, antique bronzes and valuable ceramic ware doing duty as lamps. One of the most pleasing illustrations of this is a gondola lamp, now illustrated, which helps to illumine a stone staircase at Ardkinglas.

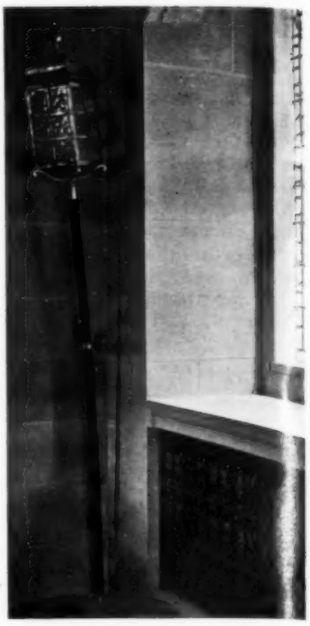
JOHN DARCH.

UNSHADED CANDELABRA.

WIRING.

As the result of many years of evolution, there are several different systems of wiring for the electric light, distinguished mainly by the nature of the protection afforded to the insulated conductors. The latter are almost invariably covered with vulcanised rubber, which prevents the electricity from straying from its allotted path, and as there is no alternative choice, they need not be further considered. But rubber affords no protection to the wires against mechanical injury, and the choice of a suitable enclosure for them is a matter of the first importance. The method originally adopted was to lay them in grooved strips of wood and to cover them with thin wood capping, and this system is still widely used, at any rate in dry positions. Many installations thus carried out with wood casing twenty years ago are still in first-rate order. The casing can be made of any pattern and any kind of wood, to suit the surroundings; it can be combined with picture rails or cornices, and in various ways worked into the wall furniture and decorations, but is always subject to this drawback—that it must be visible and accessible. Consequently, while there are many situations where it can be used without hesitation, it cannot as a rule be recommended for reception-rooms and similar places where the first consideration must be non-interference with the decorative scheme. For such apartments we must therefore choose a mode of protection which lends itself to the complete concealment of the lighting system, with the exception, of course, of the actual fittings and controlling switches.

In the case of a new building, by far the most advantageous course is to instal the wires in iron piping, which is embedded in the walls before the latter are plastered, thus ensuring perfect concealment and avoiding interference with the surface of the walls. This, unfortunately, is an exceptional case, as the great majority of country houses to be lighted with electricity are already built, and often, too, they are provided with panelled or otherwise highly-decorated walls which are regarded as almost sacred, and constitute an ever-varying problem taxing the ingenuity of the wireman to the utmost.



GONDOLA LAMP.

There remains, then, the question as to what system shall be used for wiring a house already built and occupied. Where appearance is not the predominant consideration, wood casing may be used; a better protection is afforded by steel tubing or "conduit," but this is distinctly unsightly, and can only be employed in positions where it can be tucked away out of sight or in passages and basements where it does not matter. So far we have dealt only with methods involving the use of insulated wires laid in casing or drawn into tubing; but there are other systems in which the wires are combined with their protecting covering, and these are of very great assistance in tackling the awkward problem mentioned above. One of the best, which has also stood the test of many years' trial, is that in which the rubber-insulated wires—from one to three in number, as required—are completely enclosed in a tightly-fitting leaden sheath, so that externally their appearance resembles that of a small lead pipe. This is known as the "twin-lead" system, and has the great advantage that it is flexible, so that it can be threaded behind panelling and bent to fit round or into corners and mouldings without fear of injury; it is also perfectly waterproof, which cannot be said of any system in which the wires are protected by separate coverings, such as casing or tubes. The lead sheathing, it is true, affords no protection against nails, and care is necessary not to instal this type of wiring close behind boards, etc., into which nails may be driven in the future. In many situations the lead-sheathed wire may be attached to the surface of the walls by means of small clips, being itself so small and unobtrusive that it does not materially detract from the appearance of the wall, while its deliberate exposure renders it practically secure against injury by nails; but as a rule it is laid out of sight.

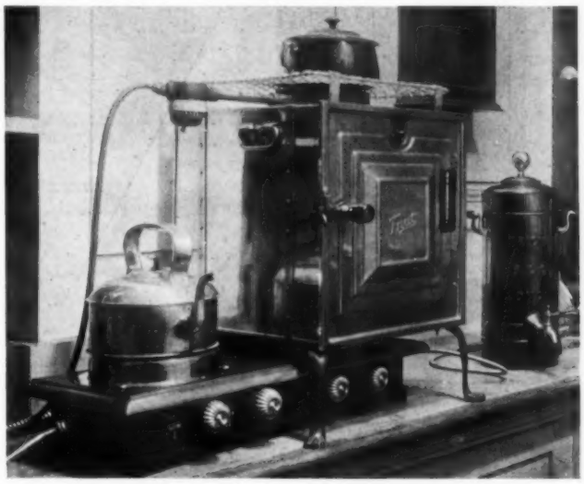
Similar systems are in vogue in which, however, instead of lying side by side, the wires are concentric—that is, one is made of copper strip and is lapped round the other, with rubber between them, the outer conductor being either left bare or enclosed in a leaden sheath. "Concentric" wires are still smaller than the twin lead-covered type, especially when the lead sheath is omitted, and are therefore extremely inconspicuous. They have the disadvantage, however, that for the connections to a switch, which must necessarily be placed on the wall at a height within easy reach, two concentric wires must be used, and in that case they are much less sightly than the twin type, of which only one is required. We have not exhausted all the possible systems in this brief

summary, but all those of importance are included. It will be seen that there is no one system which meets all possible requirements, and the natural course is to adopt a judicious combination of the various methods, utilising each under the conditions for which it is best adapted.

A few notes regarding the cost of the wiring may be of interest, though if a compromise is adopted, as suggested above, allowance must be made for its effect on the resultant cost; moreover, as no two houses of the class we are considering are alike, it is impossible to make a close estimate that will apply to all cases. The prices here given, which relate to the cost of wiring to each point where a lamp or a group of lamps is fixed, must be regarded as approximate comparative figures. The most expensive system is that in which steel tubing is used, costing 16s. to 18s. per point; wood casing comes next at 12s. to 14s. The self-contained twin-lead and concentric systems are about equal in cost, and may be set down at 8s. to 10s. per point. It will be seen that there is a considerable disparity between the prices of the various systems, but it must not be assumed that the total cost of the installation will range over proportionately wide limits, for the cost of the lamps and fittings, which must be added to each of the figures given, will reduce the ratio.

THE NEW COOKERY.

IN speaking of electric cookery, I call it the "new" cookery because, although for some years electricians have spent much time and thought on bringing it to perfection, it is only within the last two or three that it has become really practicable from the point of view of economy and efficiency. That it is the cookery of the future there can be little doubt. Its advantages are so many and so obvious that no one who has tried it would wish to return to the old methods. Very many of the electric companies supply current for cooking at one penny, or less, per unit, and as soon as this is universally done, electric cooking will tend to become as popular as electric lighting. Being neither an engineer nor an electrician, but a practical cook, it is from this standpoint that I describe electric cooking. For the past nine months I have used electric stoves for cookery of all kinds Prior to this I worked with gas and coal. The experience of all methods and types of cooking apparatus leads me to say that electric cookery is superior to any other kind in the following ways: It is easier, cleaner, safer, more hygienic and (where the current is supplied at one penny per unit) more economical.



ELECTRIC COOKER AND OVEN.

The first thing that impresses a cook on taking up electric cookery is its extreme easiness. Owing to the perfectly even heat, there is no risk of the food getting more cooked in one part than in another. Quite an unskilled cook using an electric oven can produce results which, by the old methods, could only be expected of an expert. Also, the process of cooking any particular article is always the same, because the electric current never varies. Of the cleanliness of electric cooking there can be no two opinions. There is no smoke and no soot, consequently no black saucepans and kettles are necessary. Only aluminium or block tin or earthenware need be used. Besides this, the food itself is absolutely clean, which it cannot be when cooked in an atmosphere of smoke and soot or gas fumes. With regard to the safety of the new cookery, it will be at once apparent that where there is no naked flame the advantage on the side of security is enormous.

Electric cooking seems more hygienic than any other method for many reasons. In the first place, the food is cooked in pure hot air without fumes of any kind. It is healthier work for the cook, because it is cleaner and cooler, and because all the heaviest work, such as carrying coals, making up the fire, the cleaning of flues and black saucepans, is done away with. As to the economy of electric cooking, with current at one penny per unit, the actual cost has been found to be equal to gas at two shillings and sixpence a thousand cubic feet, and everyone will agree that gas is cheaper to use for cooking than coal. But there are other things to be considered which make the new cookery economical even when a higher rate is charged for current. There is economy of health, economy of work (in many households one servant less would be required if this form of cooking were adopted), economy of space (for the usual huge kitcheners and chimney-breasts can be done away with) and economy of wall-paper and other surroundings, owing to the absence of soot and smoke. Perhaps, however, the most striking economy is in the decrease of wastage of joints. This decrease is often as much as twenty per cent., which means the saving of from tenpence to a shilling on every six or seven pounds of butcher's meat, and this amounts in a year to a considerable sum.

These are the chief points of advantage which the new cookery offers. The drawbacks are few, and easily overcome. The principal objection made seems to be the difficulty of obtaining large quantities of hot water without the usual kitchen boiler. To obtain

THREE ELECTRIC OVENS.

TWO VIEWS OF ELECTRIC KITCHEN.

enough water for several hot baths in succession by electrical means is, at present, decidedly expensive. A good and economical way when installing electric cookers is to operate the hot-water system by a coke stove. These stoves will burn all kitchen refuse, require little stoking and, at a cost of about sixpence a day for fuel, provide an almost unlimited supply of hot water night and day.

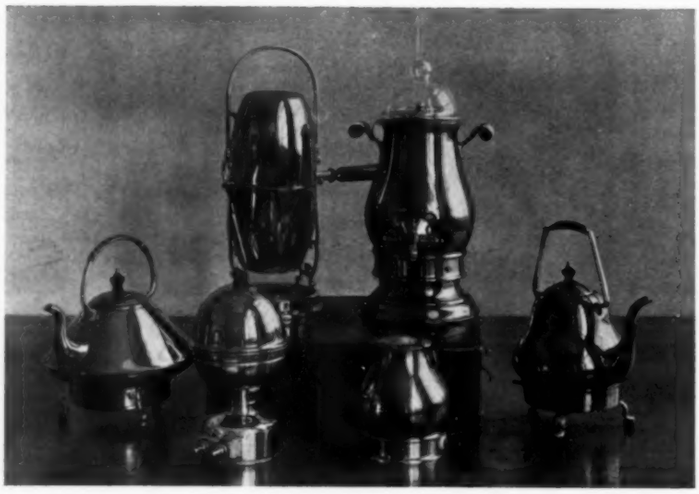
With regard to electric cooking for country houses lighted by small private generating plant, it has been objected that the use of cooking apparatus involves a very much larger installation. This is quite true as regards cooking entirely by electricity; but in many country houses the installation has been made large enough for a certain number of carbon-filament lamps, and by substituting for these the metallic-filament lamps now in general use, at least half the current is saved, and the unused balance would, in many cases, be sufficient to carry some of the smaller electric apparatus, which could be used as a convenient addition to the kitchen range. On the other hand, it is fair to add that the advent of the metallic filament lamp has brought with it a desire for more light, and the saving in current consumption is often absorbed by the use of lamps of higher candle-power.

Up to the present electric cooking has not made as much headway with the general public as its undoubted merits deserve. The popular tendency is always to look with a suspicious eye on any new thing. However, signs are not wanting of a decided awakening of interest in the subject of the new cookery. Kitchens have been opened in various parts of London and other large towns where people can see the stoves at work and judge for themselves as to their efficiency, and these kitchens are well attended by appreciative visitors. Architects and others engaged in planning domestic buildings are beginning to enquire into the matter, no doubt anticipating the time when one of the questions asked by anyone about to take a new house or flat will be, "Is it arranged for electric cooking?" just as they now ask, "Has it electric light?"

AMY CROSS.

ELECTRICAL ACCESSORIES IN THE HOUSE.

JEROME K. JEROME, in one of his books, introduces us to a man whose mental horizon was bounded by the illimitable possibilities of electricity, and who conceived vast social reforms and a social reorganisation achieved solely by the aid of the electric current. After detailing his Utopia, in which every form of labour was performed and every kind of luxury achieved by electrical energy, the reformer was pressed to suggest what further means might then be adopted to cure this naughty world, and he could only fall back on—"more electricity."



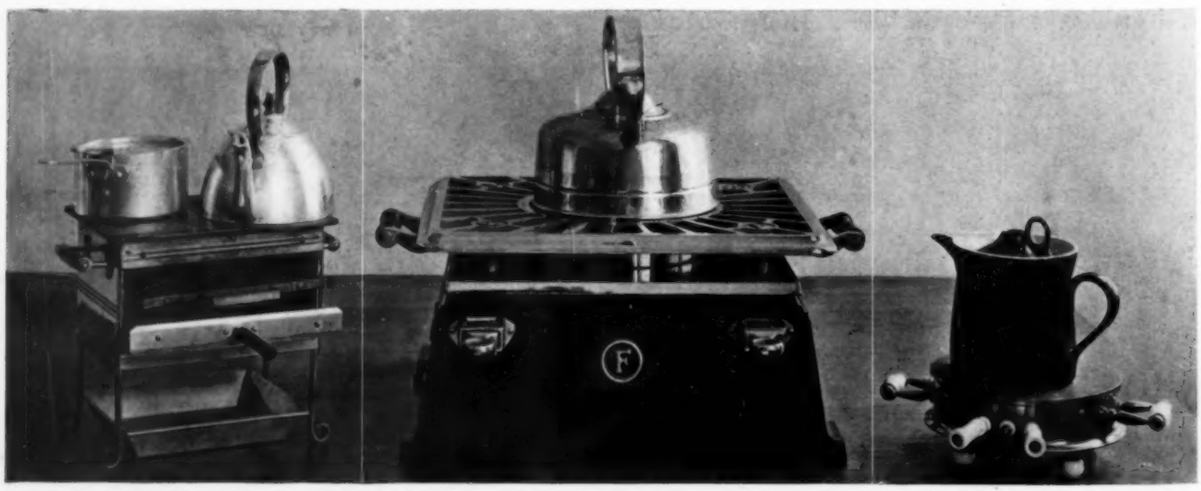
KETTLES, EGG BOILERS AND COFFEE MAKERS.

Yet time has contrived to multiply the sly satire of the humorist and to justify largely the conceptions of his victim. With the uses of electricity for lighting, for telephones and telegraphs, for running trains and trams and for electric bells the average man is fairly acquainted. He may have heard something of its possibilities for cooking; but the fact that a breakfast for three people, consisting of coffee, toast, fish, eggs and bacon, can be cooked in twenty minutes at a cost for current of one-third of a penny, is unknown to him. And this, too, without mess or dirt, on an apparatus about twelve inches square and fourteen inches high, standing on the dining-room table.

Now and again the daily Press gives a glowing account of the house of some electrical enthusiast, so fitted that the electrical current wakes him in the morning, makes his early cup of tea, boils his shaving water, supplies him with a warm bath, cooks his breakfast as he leisurely dresses, and so on; but the recital somehow leaves the general public cold. Our innate conservatism was ever the despair of the inventor. "You cannot get the public to take these things up," said an electrical expert. "You can do hundreds of things in a more cleanly and more economical manner by the use of electricity than by other means in vogue; but it is almost impossible to secure the interest of the public. I suppose electricity seems uncanny."

The introduction of electricity into a house, even of moderate size, opens up extensive possibilities of labour-saving through the agency of the electric motor. The quite small motor of to-day has been developed into a workmanlike machine which bears favourable comparison with its larger brethren and, in many cases, it uses such a small amount of electricity that it is quite feasible to connect to the ordinary lamp-holder by means of a plug and flexible cable.

The following are typical instances of the use of small domestic motors: The sewing-machine requiring 1-30th to 1-12th h.p.:



BREAKFAST COOKER.
(*Boiling, grilling, toasting, etc.*)

BREAKFAST COOKER.
(*Double heat.*)

HOT PLATE.
(*Two heats.*)

HOT PLATE.

HOT PLATE.

ELECTRIC TOASTER.

polishing machine, 1-16th h.p.; boot-cleaning, 1-6th h.p.; coffee-grinder, 1-16th h.p.; rotary knife-cleaner, 1-6th h.p.; vacuum cleaner, 1-10th to 1-4th h.p.; washer, 1-10th h.p.; combined wringer and washer, 1-6th to 1-4th h.p.; "Dolly" washer, 1-4th h.p.; small ventilating fan, 1-12th to 1-8th h.p.; and so on.

In the case of some of the apparatus above-mentioned, such as vacuum cleaners and fans, the motor is usually incorporated with the machine, but for the driving of many of the kitchen appliances it may be convenient to fix the motor to a wall or special table and to clamp the knife-cleaner, polisher or other appliance to the table, driving it through a speed-reduction gear, cheap forms of which are obtainable.

A very handy device recently introduced, and familiarly known as the "Electric Mary Ann," takes the shape of a portable combined electric motor and driving gear, which is, say, clamped to a table near the appliance to be driven, rotation being obtained by means of frictional contact between the wheel of the driving gear and that of the appliance.

The first cost of a little motor for driving kitchen plant such as knife-cleaners, etc., depends on circumstances; but a good 1-30th h.p. motor, for 2,000 revolutions a minute, weighing 14lb., can be obtained for under £2, and an 1-8th h.p. machine of the same speed and one-third greater weight for under £3. The cost of the necessary switch, with flexible and plug, would be about another £1. The cost of working small motors of up to 1-4th h.p. for the brief periods required in the kitchen is so small as to be negligible.

Of course, there is a secret, especially in the matter of economy. For cooking and other household purposes it is essential to secure a "power" supply, distinct from that for lighting purposes. In country houses, with an independent installation, some modification and increase of the ordinary lighting plant may be all that is required; but where an electrical supply is obtainable a separate "power" service is needed, and an arrangement of wall plugs in various convenient places to utilise the current for power purposes. The difference in price between current supplied for power and for lighting purposes is in itself rather a stumbling-block to the public mind. Gas it knows, and for every cubic foot used the price is the same. So it is not clear to people why an electrical supply company that charges them, say, 5d. or 6d. for every unit used for lighting should be willing to let them have current at a penny or three-halfpence a unit for power purposes. The explanation lies in the essential differences of production. A gas company carbonises so many tons of coal and obtains so many cubic feet of gas therefrom. This they store, and it is immaterial to them whether the public uses this gas up in the day-time or during the night. The electrical company, however, has to keep its machinery running at full capacity at night in order to supply millions of lamps with current. Nine-tenths of its work has to be done at night, and it is on this consumption that its figures as to cost of production and profit have to be based. What every electrical company desires is a good "day load" on its machinery. It is an ordinary industrial axiom that if you can keep machinery going continuously you decrease the production cost on each respective article it turns out, as the cost of the machine, the interest on the outlay and the sinking fund charges remain the same. As an electricity supply company has to look for its profits on the "night load," it follows that its plant has little to do during the day, and that the current used during the day is largely the source of extra profit. It can therefore be supplied at a much cheaper rate.

Taking the power charge of a large London supply company at a penny per unit, let us see what we can do in the way of minor accessories for comfort and convenience in the house. Take first one or two things of special interest to women. There is the vibrator, or face massage machine, to be purchased for £3 10s. Face massage is a valuable treatment for tired nerves, headaches and for preserving the complexion. This machine will work for twenty hours for a penny. Then there is a hair-drier. The mere male has, probably, little conception of the worry that a woman's crowning glory is to her. Shampooing and washing are a great trouble, for the after-drying is a long and tiresome operation, and if not effectually done may lead to colds and neuralgia. This little drying-machine costs £2 5s., works twenty hours for a penny and produces a current of either warm or cold air at will by the mere pressure of a button. There is a curling-iron-heater at 37s. 6d. that heats the irons in two or three minutes and works eight hours for a penny. The woman who suddenly requires some little thing ironed knows the annoyance of having to wait while an iron is heated, and the danger of it being over-heated. For her, electrical irons are obtainable from 10s. 6d. upwards, and they work two and a-half hours at a cost of a penny.

For the woman who does needlework there is the electrical sewing-machine. The motor and regulating switch cost £6, but

TONGS HEATER. HAIR DRIER. HAT PAD. HUMIDIFIER. VIBRATOR. DOMESTIC IRONS.

one pennyworth of current will work the machine continuously for twenty hours, and the mere pressure of the foot will regulate the speed. To refresh the air there is an ozone machine, working seven hours for a penny; or, if the air is too dry, a humidifier will distribute moisture or scent the room for a hundred hours at the same cost. Ordinary fans for cooling cost anything up to, say, £2, and work twenty hours for a penny.

Warm towels may be ensured in the bathroom at a cost of a penny for each seven hours the nickel-plated towel-rail is in use; hot shaving water for the men at a penny for each four hours, ten minutes at the outside being required to get up heat. The master of the house may also have his silk hat polished by heated hat-pads, working fifty hours for a penny, or ironed by "hot point" irons, working four hours for the same sum. He may light his cigars by electric cigar-lighters at a cost of a penny for twenty hours—practically a penny a year or less.

To meet the needs of the office man there is a small water-heater, which, set going when he arrives in the morning, will give him a gallon of hot water for just under one penny by lunchtime. The larger water-heaters are usually run on contract with the supply company. One of sufficient capacity for a small or bachelor's flat, supplying baths and all domestic requirements, would work out at about £1 a quarter.

In the region of domestic economy there are many time and labour saving appliances. The parquet or wood-block floor polishing-machine works three hours for a penny, and is adapted for either polishing alone or for cleaning off the surface to a true and smooth level. This works with a rotary motion. A metal polishing appliance, very useful for cleaning rusty surfaces, works ten hours for a penny. The knife-cleaners work five hours for a penny, and ensure even wear on the knives. Electric clocks, so connected that the clocks all over the house are synchronised and show the same time, each costs in current about a penny a year. Then we have vacuum cleaners operated by electricity, either in portable or in fixture form. Bed-warmers are another application, saving much trouble, being valuable in cases of illness and for the treatment of lumbago, sciatica or rheumatism. Moreover, as long as the current is on, the warmer gives heat, in contrast to the hot-water bottle that gradually cools off. Then there are heating-pads for poulticing, bronchitis kettles and sterilisers, all working for several hours at a cost of a penny.

For cooking, electricity is specially adapted, and it is claimed to be the most economical method, not merely in the cost of the cooking medium, but also in preventing wastage of the food. The electrical equipment of kitchens forms the subject of a separate article, but reference may be made here to numerous appliances for performing small culinary operations on the dining-room table. These can be connected up to any convenient plug in the room. Hot toast can be produced on the breakfast-table at a penny an hour. Coffee can be made in about ten minutes in an appliance costing 37s. 6d. and working four hours for a penny. A penny or twopence would suffice to cook all the breakfast eggs for a month. Of hot-plates there are innumerable varieties and sizes. Breakfast and supper dishes can be cooked with these on the table; and, in general, it is better to use ordinary saucepans on a hot-plate than to use self-contained electrical saucepans, as servants are apt to stand these in wet sinks and in time rust will destroy the heating medium. One hot-plate in nickel silver, 2ft. 3in. long and costing £4 2s. 6d., would serve two and a-half hours for a penny. Others give up to six hours' efficiency for the same money. A hot-cupboard may be worked two hours for a penny, and is a useful auxiliary if there is much distance between dining-room and kitchen.

Nearly all these appliances can be connected up to an ordinary lighting plug; and this is what is usually done. An attachment tea-kettle, say, is bought, connected up to a wall plug for lighting, and the electric light bill runs up accordingly. Electricity is then voted to be too dear, which brings us back to our initial point—that the basis of success and economy in the use of electricity for domestic purposes, other than light, is the installation of a "power" service where the charge current is reduced to a very low figure. This means a separate wiring installation; but, given this factor, there is no reason why houses should not be more frequently equipped with the accessories mentioned and greater comfort, convenience and economy secured

HEATING BY ELECTRICITY.

WHILE it cannot be contended that electric heating on a large scale is economically practicable, where the electricity is generated from coal or oil, owing to its comparatively high cost under such conditions, there are circumstances in which it is not only convenient, safe and hygienic, but also reasonably moderate in cost. Where, for example, there is a sawmill on the estate and wood fuel is abundant, if the sawmill is continuously employed it may well prove a good plan to drive the saw with an electric motor and to use the surplus energy for heating purposes. Similarly, where the electricity supply is derived from water or wind power, the conditions are peculiarly favourable to electric heating, for the cost of the latter is then at its minimum value; and, in fact, the more fully the available energy is utilised, the cheaper it becomes. In such a case—given an adequate supply of electricity—there is no difficulty in carrying out by electrical means the whole of the heating and cooking required by the household including the provision of a constant supply of hot water for all purposes. These conditions, however, are admittedly exceptional, and this article will therefore deal mainly with the most usual case—that of a country house provided with electric plant driven by a steam or oil engine and a storage battery.

The arguments in favour of electrical heating are then based entirely upon its intrinsic advantages. The appliances employed are light and readily portable, so that they can be carried from room to room and set down precisely where they are required; they are connected to the source of supply in a moment, without fear of leakage or danger of any kind, by means of an unobtrusive flexible cord and a plug inserted into a wall socket; they emit no fumes and consume no oxygen, so that the atmosphere is not vitiated in any way; further, they are clean, so that they can be used in the most tastefully-furnished drawing-room or boudoir without fear of the consequences; they are made in a great variety of artistic designs; and they do not tarnish or deteriorate quickly.

CONVECTOR HEATER.

While an electric radiator of good design is totally free from fire risk in itself, it should not be forgotten that improper use of almost any appliance is liable to result in mischief; for example, if clothing is aired by laying it on a radiator, instead of hanging it up in front of the apparatus, the temperature of the radiator thus covered up may rise to a dangerous degree, and either injure the heater or set fire to the clothes. No one would dream of using a gas or oil stove in such a way; but the flameless character of the electric radiator, which, under proper usage, never gets too hot, may inspire an undue confidence in its inability to attain a dangerously high temperature under any conditions.

Numerous types of radiators of widely different construction are now on the market at reasonable prices. One of the most popular types is the "luminous" radiator, in which the heating elements take the form of elongated electric lamps, giving out a certain proportion of light as well as heat. This type offers the advantage that a broken heater is easily replaced by the owner; on the other hand, the lamps are fragile, and somewhat expensive, so that the process of replacing the heaters, if often required, may be found unduly costly. Instead of the lamps, however, wire spirals are now available, which can be substituted for the lamps in radiators of this description, and are both more robust and less expensive. Besides the lamp radiators above-mentioned, there is an ingenious radiator of luminous type in which the heater consists of small wire spirals enclosed in tubes of quartz, which become redhot when in use, and emit a pleasant glow.

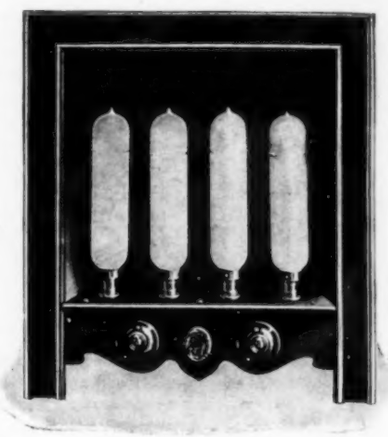
Many types of radiator give out heat only, without light; they may be classified under two heads — radiators proper and "convectors." The former are designed to fulfil their purpose by the direct radiation of heat, after the fashion of hot-water pipes, for example. There is, in fact, one kind of radiator in which the principle of the hot-water system is actually adopted; the electric heater is immersed in a quantity of oil, which circulates through

nest of pipes or channels forming part of the apparatus itself. "Convectors," on the other hand, are intended to be traversed by a current of air, which is heated in its passage through the apparatus and rises from it, spreading over the ceiling and circulating through the room, as in the ordinary hot-air system. Each type necessarily partakes to some extent of the character of the other, and each is suitable for particular applications. Where a room is to be uniformly warmed, the convector is preferable; it must be given time to effect its object. Where, on the other hand, local warmth is required, and quickly, the radiator properly so called is better adapted to the needs of the occasion. There are also made heaters that combine luminous heat for warming the person direct and non-luminous heat for warming the air.

To meet the complaint which is sometimes made, that electric radiators, like gas-stoves, dry the air in a room too much, a device has just been introduced which provides for the evaporation of a small quantity of water by the radiator itself to keep the air comfortably moist. But the complaint is largely due to a different cause—the neglect to provide adequate ventilation for the room. A coal fire has the great advantage that it not only heats a room, but is also an efficient ventilating agent; an electric radiator, on the other hand, is a heater pure and simple, and care should be taken to ensure that its use does not lead to neglect of the equally essential function of ventilation. An excellent solution to this problem is the plan of placing radiators in Tobin ventilating ducts, so that the air is heated as it comes into the room.

ELECTRIC RADIATOR.

It should be noted that, where the cost of electricity is a consideration, the electric radiator unaided is not suitable for warming large rooms, or for all-day use; but for heating a bedroom or study, or the corners of a large room which are not adequatelyheated by the fire or other main source of warmth, it is ideal. To give an idea as to the cost of heating rooms by electricity is almost impossible, owing to the extreme variability of the conditions met with; it may, however, be mentioned that an ordinary size of portable radiator consumes about one kilowatt, and will therefore cost 3d. an hour, if electricity costs 3d. per unit. Similarly two gallons of water can be heated to boiling-point for the same expenditure.



LUMINOUS HEATER.

It is, however, in its adaptability to special applications that electric heating is found at its best. It is unique in that the heat is produced exactly where it is required, and nowhere else, and it can be utilised in situations where no other heating agent can be applied.

"HEALTH, Comfort and Cleanliness in the Home" is the title of an interesting little book on electric cooking by Mrs. Amy Cross, published by the Westminster Electric Supply Corporation, chiefly for the information of those consumers who take their current from the Corporation's mains. It will be of interest, however, to everyone who contemplates installing an electric kitchen, and sets out in a temperate and readable way the many advantages which may be claimed for a use of electricity that has a great, and as yet hardly realised, future.